Appendix A

Study Plan

System Impact Study

Study Plan

Calpine Corporation

Central Valley Energy Center

Final

Revision 1

Pacific Gas and Electric Company

July 2, 2001

Table of Contents

Introduction

Calpine Corporation (Calpine) has requested Pacific Gas & Electric Company (PG&E) conduct a System Impact Study (SIS) for the Central Valley Energy Center (CVEC) Project. The CVEC project is 1,097 MW (nominal) generating facility to be built near Fresno, California. The project is scheduled to be on line in January 2004. This SIS will determine the:

1) An evaluation of the transmission system impacts caused solely by the addition of the CVEC project.

2) System reinforcements, if any, necessary to mitigate the impact of the CVEC project under all system conditions.

This Study Plan will form the basis for the SIS agreement by defining the scope, content, assumptions, and terms of reference of the SIS.

Study Fee

A one-time study fee for performing the SIS is $100,000. $50,000 is due with the submittal of SISA, and the balance of $50,000 will be due on June 1, 2001. If the Applicant chooses not to continue with the study after receiving this Study Plan, a fee of $5,000 shall be assessed to reimburse PG&E for the cost of processing the Study Request.[1]

Schedule

Due to the size and the complexity of the CVEC project, it is not possible to complete the SIS in 60 days. The following schedule shows the milestones associated with the study.

Task	Milestone Description	Target Date
1	Establish study commencement date based on receipt of study fee	4/6//01
2	Send draft report to developer and Cal-ISO for review and comments	8/16/01
3	Receive comments from applicant and Cal-ISO	8/24/01
4	Issue Final SIS report	8/31/01

PG&E must receive a completed System Impact Study Agreement (SISA) from the Applicant (including the study fee) by April 6, 2001. A blank SISA may be found at the end of this document. If PG&E does not receive the completed SISA by this date, the Interconnection Application will be considered as withdrawn and the Applicant's project position in the generation Interconnection Queue shall be lost.

[1] Refer to PG&E's Transmission Owner Tariff TO4 Terms and Conditions.

Cost Estimates

No cost estimates will be provided in this SIS. Cost estimates will be provided when the project progresses to the Facilities Study (FS) phase.

Project Information

Based upon information provided by Calpine, the CVEC project is located near the city of Fresno, Fresno County, California and in the vicinity of PG&E's Helm Substation. Figure 1 shows the area in which the project will be constructed along with the transmission facilities in the area.

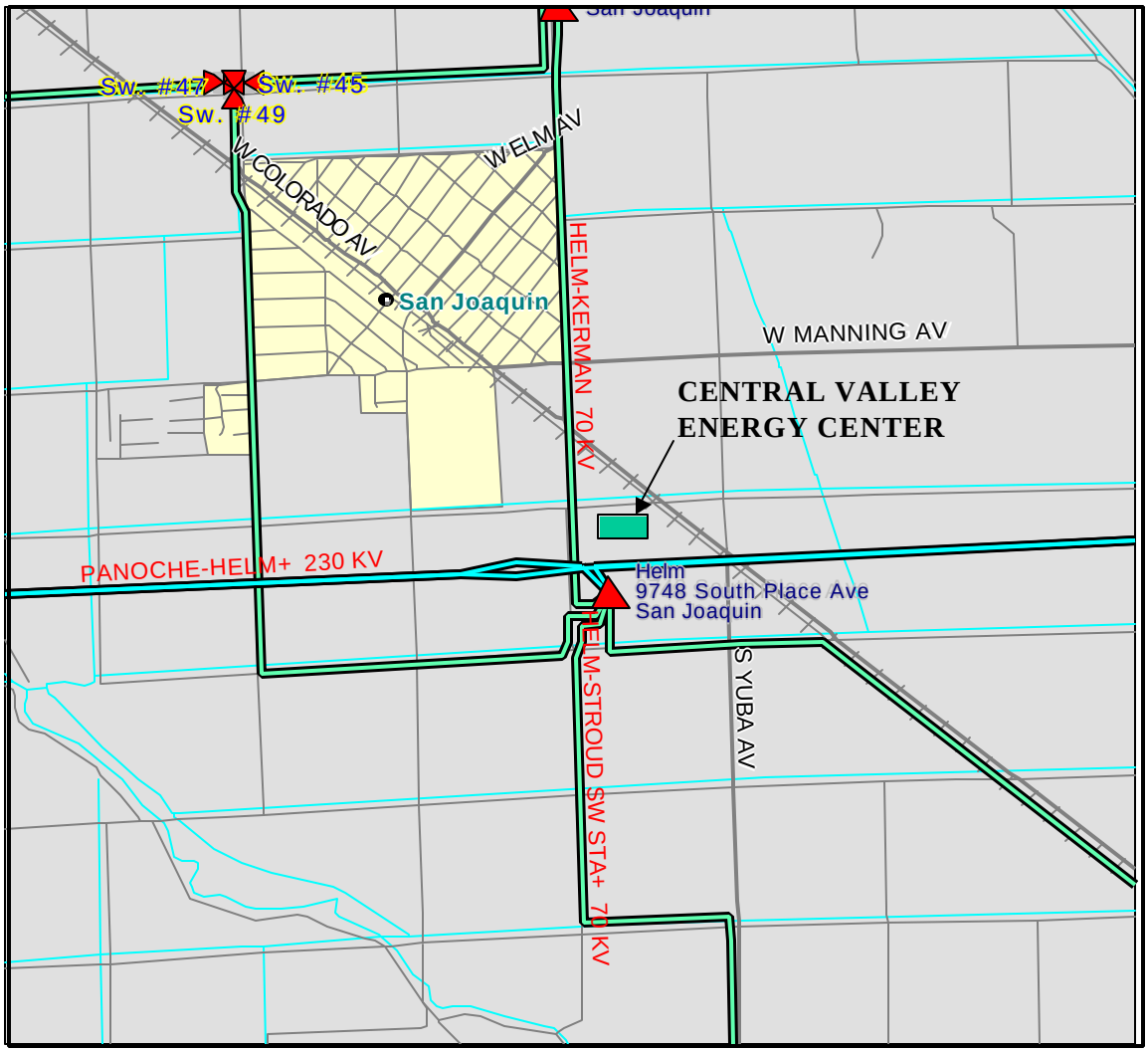

Figure 1: Central Valley Energy Center & General Vicinity

The project will have a maximum output of 1,097 MW modeled at 0.85 power factor with 35 MW of plant load. The CVEC project will be an advanced combined cycle with the following units:

a) Three - GE combustion turbine/generator (CTG) rated at 250 MVA (nominal) each.

b) One - steam turbine/generator (STG) rated at 623 MVA (nominal).

Each CTG unit will have a dedicated 18/230 kV step-up transformer, rated 150/200/250 MVA (OA/FA/FA). The STG unit will have a dedicated 19/230 kV step-up transformer, rated 400/533/667 MVA (OA/FA/FA).

Operating at baseload and without steam injection and duct firing, the project capacity is approximately 835 MW. Through incorporation of a larger steam turbine and the use of steam injection, fogging, and duct firing, the project allows for approximately 260 MW of on-peak peaking capacity. The project's maximum output depends upon temperature:

1) At 100° F, maximum output is 1,062 MW (peak case).

2) At 61° F, maximum output is 1,097 MW (spring case).

Interconnection Plan

The interconnection of the CVEC project to PG&E's grid will be accomplished by looping the Panoche – Kearney 230 kV circuit into and back out of the Helm Substation and connecting the CVEC plant to Helm Substation via two 230 kV transmission lines. It is assumed that the Applicant will build the CVEC power plant and the 230 kV bus and substation, and PG&E will construct and operate the two new transmission lines.

A single-line diagram for the CVEC project is shown in Figure 2.

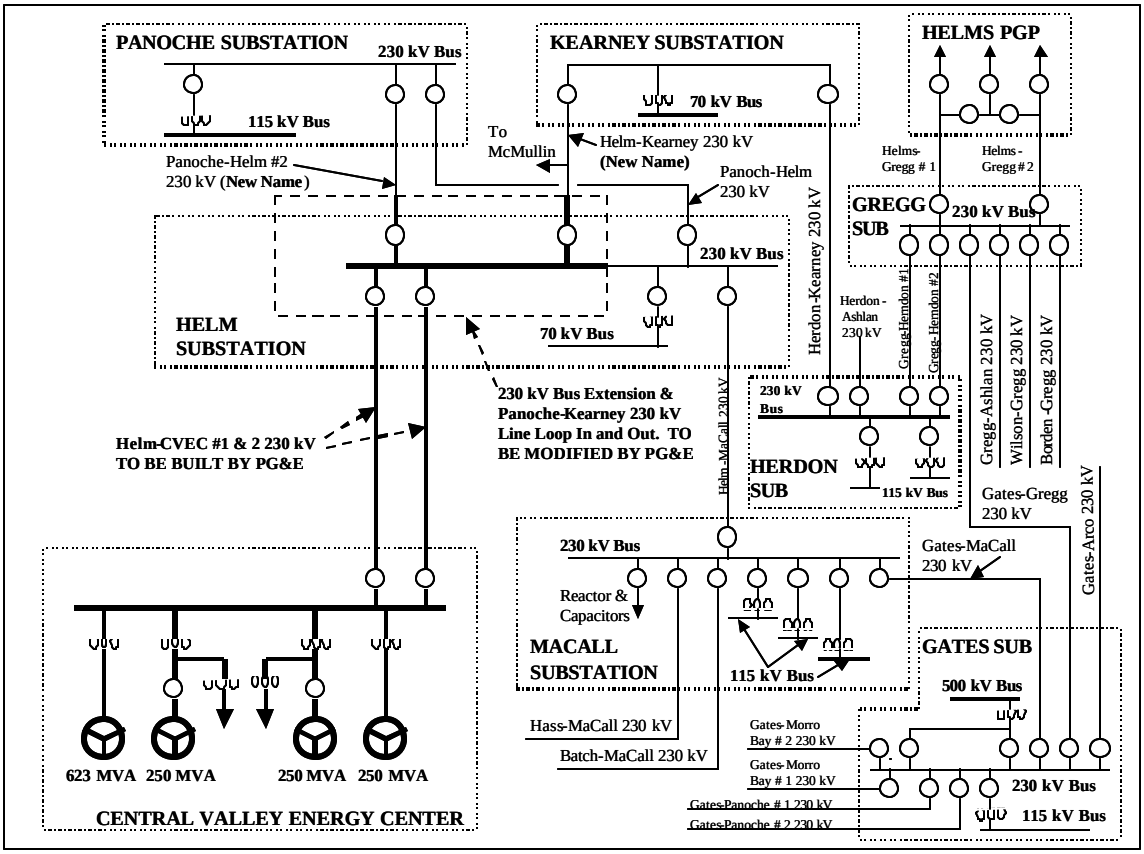

Figure 2: Single Line - Central Valley Energy Center

Study Assumptions

PG&E will conduct the SIS using the following assumptions:

1) The maximum delivery from the proposed project to the PG&E transmission grid will be 1,062 MW in summer and 1,096 MW in the spring. Generation output will be modeled at 0.85 lagging power factor.

2) The generator will be connected to PG&E's 230 kV transmission system in January 2004.

3) The plant load of 35 MW will be modeled.

4) Applicant will design, construct, own and maintain the CVEC including 230 kV bus and substation.

5) It is assumed that PG&E will design, build and own two new 230 kV transmission lines (generation tie lines) that connect the CVEC project and the 230 kV bus at the Helm Substation.[2]

6) It is also assumed that PG&E will loop the Panoche-Kearney 230 kV line into and back out at the Helm Substation and expend the 230 kV bus to accommodate the two new generation tie lines. The Panoche-Kearney 230 kV line will be renamed to Panoche-Helm # 2 230 kV line and Helm-Kearney 230 kV line.

7) The study will take into account the planned generating facilities in Northern California whose schedules are concurrent with CVEC's schedule. Any applicable Remedial Action Scheme (RAS) or system upgrades for the related generation projects will be modeled. These facilities are described in the section discussing the power flow base cases.

8) The study will take into account all the approved PG&E reliability projects that will be operational by January 2004.

9) The California-Oregon Intertie (Path 66), Midway - Los Banos path (Path 15) and the Northern-Southern California Intertie (Path 26) transfer limits will not be increased from their current limits to accommodate the CVEC. It is assumed that the CVEC output can be accommodated within the transfer capabilities of Path 66, Path 15 and Path 26. The published transfer capabilities for the PG&E service area are contained in the Path Rating Catalog, available from the WSCC.

10) The study will take into account the planned generating facilities in California whose schedules are concurrent with CVEC's schedule. Any applicable Remedial Action Scheme (RAS) or system upgrades for the related generation projects will be modeled. These facilities are described in the section discussing the power flow base cases.

Power Flow Base Case Assumptions

Three power flow base cases will be used in this study:

1) 2004 Summer Full Loop Base Case:

The 2004 Summer Full-Loop Base Case models the PG&E transmission system and expected operating conditions during the summer peak. Path 66 (California-Oregon Inter-tie) and Path 26 (Northern-Southern California Inter-tie) will not exceed the north-to-south transfer capabilities of 4,800 MW and 3,000MW respectively. Helms PGP is in the generating mode with three generators at full output. The 2004 Summer Full Loop Case will be used for power flow analysis, post transient power flow analysis, and dynamic stability analysis.

2) 2004 Winter Full Loop Base Case

The 2004 Winter Full-loop Base Case models the PG&E transmission system

[2] These lines will be modeled as bundled1113 ACSS conductor, 0.25 miles long.

when loads are generally low, generators are bucking and/or operating at minimum output, CDWR units in the Midway area are in the pump mode and Path 15 (Midway-Los Banos 500kV) typically does not exceed the south-to-north path capability of 3,450 MW. This case also assumes that the Helms PGP is in the pumping mode with all three pumps at full load. The 2004 Winter Full Loop Case will be used for steady-state power flow analysis, post transient power flow analysis, and dynamic stability analysis.

3) 2004 Heavy Spring Full Loop Base Case

The 2004 Spring Full-loop Base Case models the PG&E transmission system during a warm spring day when Hydro units are generating at full output. Path 26 (Northern - Southern California Inter-tie) typically does not exceed the north-to-south transfer capability of 3,000 MW. All CDWR pumps in the Midway area are assumed to be offline. This case is assuming that the Helms PGP is in the pumping mode with all three pumps at full load. The 2004 Spring Full Loop Base Case will be used for steady-state power flow analysis, post-transient analysis, and dynamic stability analysis.

Base Case Generation Assumptions

The base case includes the following proposed generating facilities in the northern California area:

1) Calpine/Bechtel - 880 MW Delta Energy Center (DEC), interconnecting with the 230 kV bus at the Pittsburg Power Plant switchyard.

2) Calpine/Bechtel - 600 MW Metcalf Energy Center (MEC), interconnecting with the Metcalf - Monta Vista #4 230 kV line, through the MEC switchyard.

3) PG&E NEG - La Paloma generation facility interconnecting at Midway 230 kV bus section D; La Paloma generation facility will be will be modeled at 1110 MW in summer and 1160 MW in spring and winter.

4) Calpine - 500 MW Los Medanos Energy Center (LMEC), interconnecting with the 115 kV bus at the Pittsburg Power Plant switchyard.

5) Texaco - 338 MW Sunrise Generation Facility interconnecting at La Paloma Switching Station.

6) Three Mountain Power Company - 530 MW project interconnecting to PG&E's Pit 1 – Pit 3 and Pit 1 – Cottonwood 230 kV lines.

7) GWF - 130 MW Hanford, interconnecting to Kingsburg - Henrietta 115 kV line in Fresno area.

8) Duke Energy North America Corporation (DENA) - 1080 MW Moss Landing project (MLPP), interconnecting with the existing 230 kV bus at the Moss Landing Power Plant.

9) Southern Energy Company of California - 530 MW Contra Costa Power Plant Capacity Increase Project, interconnecting to Contra Costa PP 230 kV bus.

10) Central Reliability Energy Center - 45 MW project in San Jose/San Clara area.

11) The Midway-Sunset generation facility will be 500 MW in summer, 540 MW in spring, and 540 MW winter. Midway-Sunset generation facility will be interconnected at Midway 230 kV bus section E.

12) Sempra - 500 MW Elk Hills Power Project, interconnecting at Midway 230 kV bus.

13) FPLE High Wind Project – 150 MW Project, tapping off the Vaca -Contra Costa #2 230 kV line.

14) United Golden Gate PP - 595 MW generating facilities, interconnecting with the San Mateo - Martin #5 and #6 115 kV lines.

15) Project A - 692 MW Tesla Generation Project , interconnecting near Tesla Substation.

16) Project B – 580 MW Fremont Generating Project interconnecting to the 230 kV bus at Newark Substation.

17) Project C – 581 MW Los Esteros Generating Project interconnecting to the 115 kV bus at Los Esteros Substation.

18) Wellhead Electric - 22 MW Stockton Cogen Project, interconnecting with Newark Sierra Paper Board 60 kV Tap on the Stockton “A” #1 60 kV line.

19) Morro Bay Modernization Project replacing the existing Morro Bay Power Plant with 1,200 MW of generation.

20) Panda - 150 MW West 1-3, interconnecting with Vaca Dixon - Contra Costa #1 230 kV line.

21) Mirant - 600 MW Potrero Unit 7 Project, interconnecting Potrero and Hunters Point Switching Stations.

22) Calpine Corporation - 500 MW Sutter facility, interconnecting with WAPA’s Elverta - Olinda and Elverta - Keswick 230 kV.

23) FPLE - 560 MW Elverta Project, interconnecting with WAPA system.

24) Calpine – 1,070 MW East Altamont Generating Project interconnecting at loop the Tracy - Westley 230 kV circuit near Tracy Substation.

Study Scope

The SIS will study the impact of CVEC’s added generation on PG&E’s transmission system. The specific studies conducted for the SIS are outlined in this section.

Steady State Power Flow Studies

The three base cases will be used to simulate the impact of the new facility during normal operating conditions, as well as, single and selected multiple (ISO Categories "B" and "C") outages. The study will cover the transmission facilities within PG&E's Fresno, Yosemite and Kern planning areas.

The single (ISO Category "B") and selected multiple (ISO Category "C") contingencies include the following outages[3]:

ISO Category "B"

- B1 - All single generator outages (60 - 500 kV)
- B2 - All single transmission circuit outages (60 - 500 kV)
- B3 - All single transformer outages (60 - 500 kV)
- Selected overlapping (single generator unit and transmission circuit) outages

ISO Category "C"

- C1 - Bus section outages
- C2 - Breaker failures (excluding tie and sectionalizing breakers only)
- C3 - Selected combination of two successive category B outages (except ones included above in Category "B")
- C5 - Outages of double circuit tower lines

System Protection Study

Short circuit studies will be conducted to determine the fault duties on existing PG&E facilities before and after the CVEC project addition. The fault duty results will then be used to identify overstressed equipment, if any that results solely from the addition of the CVEC project. New protection requirements, together with protection modifications needed at the nearby transmission substations, will also be identified.

Dynamic Stability Study

Dynamic stability studies will be conducted using all three Full Loop Base Cases to ensure that the transmission system remains in operating equilibrium through abnormal operating conditions after the new facility begins operation. Other PG&E transmission projects and new generation projects that will be operational by 2004 will also be modeled in the base case.

[3] As soon as the "B" and "C" outage list is put together, PG&E will send it to Cal-ISO for review and comment.

Disturbance simulations will be performed for a study period of 20 seconds to determine whether the new facility will create any system instability during the following outages:

NERC/CAISO Category "B" Contingencies (Summer & Spring only):

a) Full load rejection of 1,062 MW (1,097 MW spring) of the CVEC project.

b) A three-phase fault with the normal clearing time at the CVEC 230 kV bus followed by the loss of the Helm – CVEC # 1 230 kV circuit.

c) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the Panoche – Helm # 2 230 kV circuit.

d) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the Helm – Kearney 230 kV circuit.

e) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the Helm – McCall 230 kV circuit.

f) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the CVEC steam generator.

g) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the Helm 230/70 kV Transformer Bank #1.

h) A three-phase fault with the normal clearing time at the McCall 230 kV bus followed by the loss of the Gates – McCall 230 kV circuit.

i) A three-phase fault at the Gregg 230 kV bus followed by the loss of the Helm – Gregg #1 230 kV circuit.

j) A single line to ground fault at Helm 230 kV bus with delayed clearing on the Helm – McCall 230 kV circuit.

NERC/CAISO Category "B" Contingencies (Winter only):

k) A three-phase fault at the Gates 500 kV bus followed by the loss of the Gates – Midway 500 kV circuit.

l) A three-phase fault at the Gates 500 kV bus followed by the loss of the Los Banos – Gates 500 kV circuit.

NERC/CAISO Category "C" Contingencies (Bus) (Summer & Spring only):

Disturbance simulations will be performed on all sections of the following buses:

m) A three-phase fault with normal clearing time on the Helm 230 kV bus.

n) A three-phase fault with normal clearing time on the Panoche 230 kV bus.

o) A three-phase fault with normal clearing time on the McCall 230 kV bus.

p) A three-phase fault with normal clearing time on the Kearney 230 kV bus.

q) A three-phase fault with normal clearing time on the Henrietta 230 kV bus.

r) A three-phase fault with normal clearing time on the Gates 230 kV bus.

s) A three-phase fault with normal clearing time on the Herndon 230 kV bus.

t) A three-phase fault with normal clearing time on the CVEC 230 kV bus.

NERC/CAISO Category "C" Contingencies (Double Line Outages) (Summer & Spring only):

u) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the Panoche – Helm and Panoche – Helm # 2 230 kV circuits.

v) A three-phase fault with the normal clearing time at the Helm 230 kV bus followed by the loss of the Helm – McCall and Helm – Kearney 230 kV circuits.

w) A three-phase fault with the normal clearing time at the CVEC 230 kV bus followed by the loss of the Helm – CVEC # 1 & 2 230 kV circuits.

x) A three-phase fault with the normal clearing time at the McCall 230 kV bus followed by the loss of the Balch – McCall and Hass – McCall 230 kV circuits.

y) A three-phase fault with the normal clearing time at the McCall 230 kV bus followed by the loss of the Helm – McCall and Gates - McCall 230 kV circuits.

z) A three-phase fault with the normal clearing time at the Gregg 230 kV bus followed by the loss of the Helm – Gregg # 1 and # 2 Circuits.

NERC/CAISO Category "C" Contingencies (Double Line Outages) (Summer only):

aa) A three-phase fault at the Midway 500 kV bus followed by the loss of the Midway – Vincent #1 and #2 500 kV circuits.

NERC/CAISO Category "C" Contingencies (Double Line Outages) (Winter only):

bb) A three-phase fault at the Los Banos 500 kV bus followed by the loss of the Los Banos – Gates and Los Banos – Midway 500 kV lines.

cc) A three-phase fault at the Midway 500 kV bus followed by the loss of the Gates – Midway and Los Banos – Midway 500 kV lines.

Post Transient Power Flow Studies

The SIS will conduct post transient studies when any outage causes greater than 5% voltage drop on the bus or buses during the power flow analysis.

Transmission Line Evaluation

The transmission line evaluation will identify existing transmission line requiring upgrades in order to mitigate overloading due to the new generation, if any.

Substation Evaluation

The Substation evaluation will identify any existing equipment, if any, requiring upgrades to mitigate problems caused by overstress or overload.

Stand-by Power

This study does not address any requirements for stand-by power that the project may require. The Applicant should contact their local PG&E service office regarding this service.

Note: The developer is urged to contact their local service office promptly regarding stand-by service in order to ensure its availability for the Project's start-up date

Pacific Gas and Electric Company

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System Impact Study Agreement

_____ (Applicant) has reviewed the study plan for the interconnection of Applicant's electric generating plant with PG&E's system at _____[4], State of California and agrees with the proposed plan.

Applicant agrees to pay the proposed study fee.

Dated this _____ day of _____, 2001

APPLICANT:

BY: _____
(Signature)

_____
(Type or Print Name)

TITLE: _____

MAILING ADDRESS:

_____

_____

_____

_____

[4] Enter city and county location of proposed facility.